RESOURCE AND EXPLOITATION OF JUVENILE PENAEID PRAWNS FROM MANAKKUDY ESTUARY

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ABSTRACT

The Manakkudy Estuary situated about 8 kilometres north of Cape Comorin in Tamil Nadu is an important source of juvenile penaeid prawns which are used as bait in hook-and-line fisheries and seed for culture, along the coasts of Kanyakumari District. It is estimated that 4 tonnes of juvenile prawns are exploited on an average every year from this environment, with peak catches in February and March. The fishery is constituted by *Penaeus indicus, P. monodon, Metapenaeus dobsoni* and *M. monoceros*. Of these, *P. indicus* is the most dominant species forming 90% of the total prawn catch. By following the progression of modes in the size-frequency distribution it is estimated that males of this species grow at the rate of 24.3 mm|month and females, 26.2 mm|month. The maximum growth rates are recorded mostly when the bar is closed when the salinity varies between 7.96‰ and 13.81‰

INTRODUCTION

The rocky inshore sea of Kanyakumari District situated on the southern extremity of the southwest coast of India is one of the productive grounds for many species of quality fishes, lobsters, large-sized prawns and mussels. George and Mohamed (1966) have made a general survey of the prawn fishery of this area and indicated prospects of its future development. A detailed investigation on the extent of this resource and biology of the constituent species was undertaken by the author during 1971-74 as a part of the All India Co-ordinated Research Project on "Studies on Marine Prawn Biology and Resources". Since no information was available on the characteristics of the juvenile population of the penaeid prawns of this area, a study of the same has been carried out during the period January 1972 to December 1973 with reference to Manakkudy Estuary situated about 8 kilometres north of Cape Comorin. The present paper deals with the magnitude and exploitation of this resource together with some aspects of the biology of the constituent species from this estuary.

MATERIAL AND METHODS

The material for the present study was collected by regular observations at a fixed point on the western side of the estuary near the bar mouth where normally the entire catch from this environment is landed. This centre was visit-

ed twice a week and details on catch and effort were recorded separately for each gear in operation. A random sample of nearly 1 kg of prawns was drawn from the commercial catches on every observation day and analysed for species composition and biological features of individual species. To estimate the monthly specieswise catch, the average weight of catch per unit-gear on an observation day was multiplied by the number of units in operation on that day and the total for all the observation days was then obtained and raised to the total number of actual fishing days in that particular month.

The total length of prawns was measured from the tip of rostrum to the tip of telson.

Hydrobiological Conditions of the Estuary

The estuary has a total area of about 145 ha extending over 2 km, bordered with vast stretches of saltpans on either side (Fig. 1). It is connected with the sea on most of the days during the rainy seasons — June to August

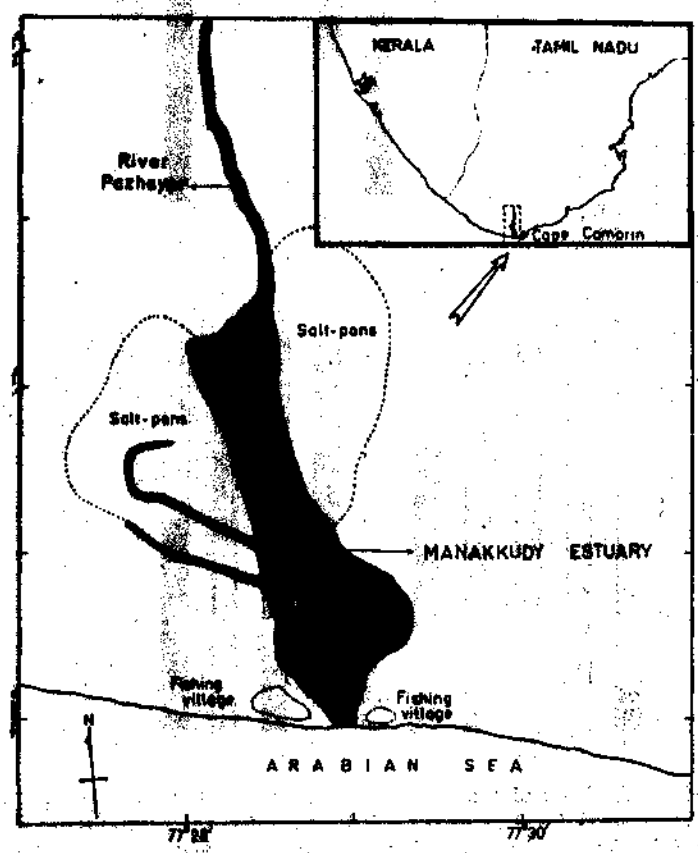

Fig. 1. Topography of Manakkudy Estuary. Hatched portions indicate deeper areas.

and October to December — due to the influx of fresh water through River Pazhayar. In summer months it generally remains land-locked, but also occasionally gets connected with the sea when the local people cut open the narrow sand bar to avoid damage to the neighbouring areas by flood caused by the accumulation of river water. The mean depth, when the bar remains open, is about 1.5 metres. This, however, increases considerably when the estuary is land-locked. Bottom of the estuary is generally muddy and in some parts mixed with sand and plenty of dead shells.

Surface temperature and salinity of the estuary were studied during the year 1973 and the observations in relation to rain fall and the bar conditions are shown in fig. 2.

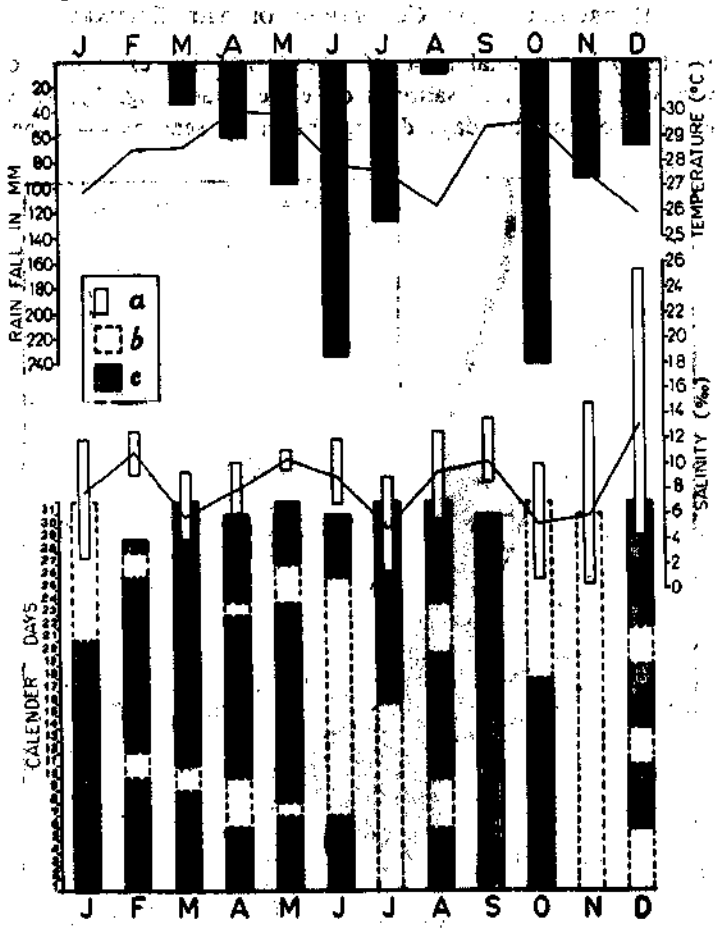

FIG. 2. Showing rain fall and the bar conditions on calender days, salinity and temperature of Manakkudy Estuary recorded during 1973. a, salinity with mean values plotted inside; b, the days when the bar was open; c, the days when the bar was closed.

The monthly mean temperature varies from 25.9°C in December to 30.0°C in April. Relatively high temperature prevails during April-May and September-October when the estuary is cut off from the sea on most of the days. The temperature shows a gradual declining trend from June to August as a result of the southwest monsoon and a sharp fall from November to December due to the combined effects of northeast monsoon and winter.

Salinity is highly influenced by the opening and closing of the sand bar. It ranges from 0.73‰ to 25.3‰ with the monthly-mean values fluctuating between 4.95‰ and 13.20 ‰. The variations are more pronounced during November and December when the lowest as well as the highest values are recorded. Normally the salinity range when the estuary is land-locked is between 7.96‰ and 13.81‰

Besides penaeid prawns, the estuary harbours many species of fishes, a few species of caridean prawns belonging to the genus *Macrobrachium*, and the green crab, *Scylla serrata*. The most common fishes are species of *Tilapia, Mugil, Etroplus, Gerres, Chanos, Therapon, Ambassis, Lates, Anguilla* and *Mystus*. The algal flora mainly consists of species of *Prasiola, Enteromorpha* and *Ghaetomorpha*, of which *E. intestinalis* is dominant.

Fishery

Fishing methods

Fishing in this estuary is the major occupation of about 80 fishermen residing in the adjoining villages. They use a number of devices, of which cast-net is the common gear employed for catching prawns which is generally operated from a small catamaran manned by two persons. Although the fishing is almost a regular practice, intensive operations are generally conducted soon after the water level falls following the opening of sand bar. When the estuary is land-locked, most of the nets are operated near the sand bar. During this period the fishermen cast the nets at fixed places after dropping coconut cakes to lure the prawns. Besides cast-nets, other gears such as gill-nets, drag-nets and small shore seines are also operated for catching prawns occasionally. The gill-nets are used mainly to catch large-sized prawns during April and September-November.

The prawn season commences from about the middle of February and lasts up to December. Generally, the fishing is more active during the first half of the year than in the second half, as most of the fishermen engaged in this fishery are attracted towards the lucrative inshore fishery for prawns (George and Mohamed 1966) and lobsters (George 1967) in the latter period.

Catch and abundance

In the total fish production prawns constitute over 40% on an average. It is estimated that an average quantity of 4 tonnes of penaeid prawns are exploited every year from this estuary, of which more than 90% is obtained by

cast-nets. The peak catches are recorded in February or March. Details of fishing effort, catch and catch per unit of effort of prawns recorded during different months of 1972 and 1973 are given in Table 1.

TABLE 1. *Estimated monthly figures of fishing effort*, catch and catch/unit of effort of prawns from Manakkudy Estuary during* 1972 *and* 1973.

Months		Fishing effort in Hrs.	Catch of prawns in kg.	Catch/unit of effort of prawns in kg/hr.
January	1972	..	..	..
February	"	1,319	306	0.23
March	"	2,759	1,431	0.52
April	"	2,521	521	0.21
May	"	1,867	363	0.19
June	"	770	112	0.15
July	"	1,079	217	0.20
August	"	582	153	0.26
September	"	517	53	0.10
October	"	74	16	0.22
November	"	$	..	..
December	"	$	..	..
TOTAL/AVERAGE		11,488	3,172	0.28
January	1973	..	..	..
February	"	1,491	1,322	0.89
March	"	1,283	382	0.30
April	"	735	174	0.24
May	"	1,846	787	0.43
June	"	1,915	1,035	0.54
July	"	1,267	480	0.38
August	"	491	77	0.16
September	"	153	88	0.57
October	"	589	381	0.65
November	"	242	36	0.15
December	"	212	24	0.11
TOTAL/AVERAGE		10,224	4,786	0.47

* Expressed in terms of actual fishing hours.
$ No prawn fishing.

As can be seen from Table 1, the abundance of prawns in the estuary shows wide fluctuations in different months. This may be due to the fact that the chances available for the entry of postlarval prawns into this environment differ considerably from month to month because of the varying lengths of time the bar remains open to the sea (Fig. 2). During the period October to December, which coincides with the peak breeding season of the penaeid prawns of southwest coast (George 1962a) the estuary is connected with the sea on most

of the days and this would favour greater recruitment of postlarvae during that period. This may be the reason for the maximum abundance of prawns in February and March.

Species composition

The fishery is constituted by four species of prawns namely *Penaeus indicus* ("Naaran"), *P. monodon* ("Panaraal"), *Metapenaeus dobsoni* ("Veliathumbu raal") and *M. monoceros* ("Paranthatti raal"). Their monthly percentage distribution for the two years studied is shown in Fig. 3. *P. indicus* is the most dominant throughout the year, forming 90% of the total catch. *M. dobsoni*, which contributes 7%, is next in abundance. Though it occurs in all the months, peak catches are recorded in February-March and September-November. *P. monodon* and *M. monoceros* are also encountered throughout the year, but the former is more common in April and September-November and the latter in May, September and November.

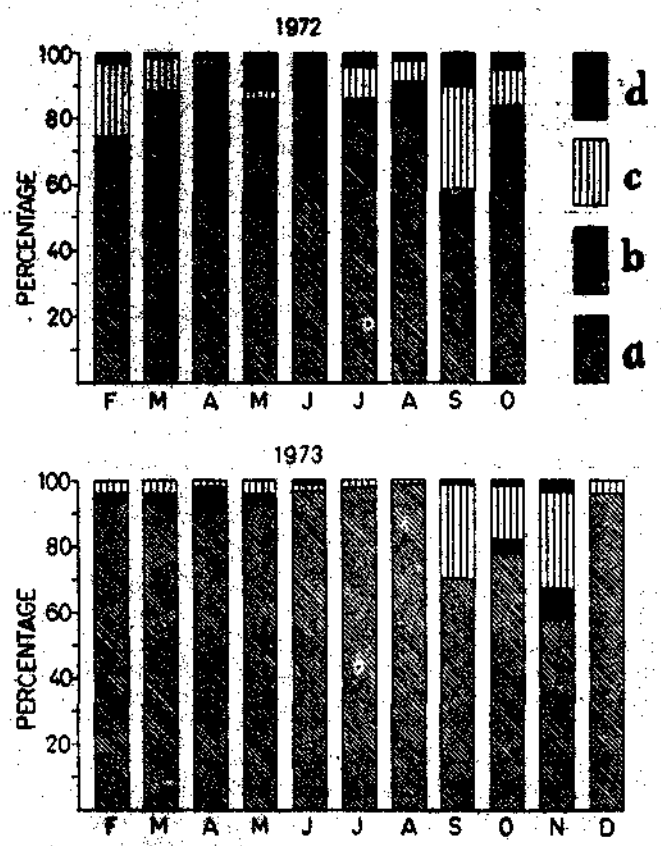

FIG. 3. Monthly species-composition of the prawn catches from Manakkudy Estuary during 1972 and 1973. a, *Penaeus indicus*; b, *Penaeus monodon*; c, *Metapenaeus dobsoni*; d, *Metapenaeus monoceros*.

Size distribution and growth

Penaeus indicus: The size range of the exploited population is 37-128 mm for males and 42-135 mm for females. But the fishery is predominantly supported by prawns measuring 56 mm to 120 mm in length. The size-frequency distribution is often multimodal. The principal mode at the commencement of the fishery in February or March is usually at 66-70 mm in both sexes and it steadily progresses in the subsequent two-three months. During May-June period, large-sized prawns measuring 106-120 mm in length either dominate or contribute to significant portion of the catch. New recruits in the size range 61-80 mm enter into the fishery again in May-June, September-October and December periods. They contribute to the fishery of the succeeding months in different modal sizes not exceeding 91-95 mm in males and 96-100 mm in females.

TABLE 2. *Progression of size modes and growth pattern of* P. indicus *in Manakkudy Estuary.*

Sex	Initial position of size mode		Final position of size mode		Interval between initial and final positions (days)	Growth observed during the period (mm)	Estimated growth per month (mm)
	Date	Model size (mm)	Date	Model size (mm)			
MALE	15-2-72	63	13-6-72	108	119	45	11.40
	14-7-72	68	5-9-72	108	53	40	22.50
	23-9-72	63	6-10-72	78	13	15	34.50
	27-2-73	68	25-5-73	118	87	50	17.10
	15-5-73	68	4-6-73	93	20	25	37.50
	8-6-73	63	27-6-73	78	19	15	23.70
	22-6-73	68	10-7-73	88	18	20	33.33
	10-8-73	88	24-8-73	103	14	15	32.10
	31-10-73	63	20-11-73	83	20	20	30.00
FEMALE	15-2-72	63	5-6-72	113	111	50	13.50
	14-7-72	68	5-9-72	108	53	40	22.50
	23-9-72	63	6-10-72	78	13	15	34.50
	27-2-73	68	15-5-73	118	77	50	19.50
	15-5-73	63	4-6-73	88	20	25	37.50
	8-6-73	68	27-6-73	78	19	15	23.70
	22-6-73	68	10-7-73	88	18	20	33.33
	10-8-73	93	24-8-73	103	14	10	21.30
	31-10-73	68	20-11-73	88	20	20	30.00

Growth rate of the species has been studied by following the progression of modes in the size-frequency distribution. Normally, the modes at which the prawns get recruited into the fishery are within 61-70 mm size and they show clear and regular shifting for varying lengths of time. Table 2 shows the growth pattern that is discerned in the progression of some prominent modes for the two sexes separately.

The estimated average growth rate of males of the species works out to 24.3 mm|month and females, 26.2 mm|month. As can be seen from the table, the growth rate shows wide fluctuations in different periods, which may be due to the prevailing environmental conditions. Comparatively higher rates of growth are observed when the estuary is land-locked. It is also apparent that the smaller size groups grow more rapidly than the larger ones. The highest growth rate recorded is 37.50 mm|month for prawns measuring up to about 95 mm. Although this rate of growth is exhibited by both the sexes alike, females are seen to grow at a faster rate than the males when the modal progression is traced to still larger size modes.

Using length-frequency method, an average growth of about 10 mm|month has been estimated for the species in Cochin backwaters (George 1962b) and a slightly faster growth of 0.49 mm|day in the adjoining paddy fields (George 1975). In the east coast, Subrahmanyam (1968) recorded an average growth rate of 14.36 to 16.0 mm|month for the land-locked population of this species in Ennore and Adyar estuaries.

Penaeus monodon: This species enters the fishery at 45-mm size. The dominant size range is 146-195 mm for males and 150-215 mm for females. Large-sized prawns occur more commonly during April and September-November when they are caught mostly by gill-nets. Males grow to a maximum size of 201 mm and females to 232 mm in this environment.

Metapenaeus dobsoni: The size ranges between 35 mm and 88 mm in both sexes, but the catch mostly consists of prawns measuring 46 to 65 mm in length. The modal size at the time of its recruitment into the fishery is normally 46-50 mm in both sexes. This steadily progresses to 56-60 mm in a month and then gradually disappears from the catches, thereby indicating a growth rate of about 10 mm|month. Mohamed and Rao (1971) estimated an average growth rate of 9.88 mm|month for this species in Cochin backwaters, while George (1975) noticed a faster growth of 0.35 mm|day in the adjoining paddy fields.

Metapenaeus monoceros: This is mostly represented by prawns in the size range 61 mm to 90 mm, with modes at 71-75 mm for males and 76-80 mm for females.

Sex Ratio

The two sexes of *P. indicus* are almost equally represented in the catches in all the months. In the case of *M. dobsoni*, there is a slight preponderance of females, while in *P. monodon* and *M. monoceros* the overall percentage ratio of male to female is 53:47 and 55:45 respectively.

Utilisation of Catch

The prawn catch from this estuary is one of the major sources of baits for hooks-and-lines which are extensively operated along the inshore sea of

Kanyakumari district. About half of the catch every day is sold to the fishermen for using as baits at an average cost of Rs. 3|- per hundred prawns. Some quantity is also utilised for local consumption. Large-sized prawns are entirely sold for freezing purpose. In February and June enormous quantities of small-sized juveniles of *P. indicus* caught from this estuary are used for culturing in saltpan reservoirs (Suseelan 1975).

General Remarks

The most striking feature noticed in the present survey is that *P. indicus*, which seldom occurs as a dominant item in the estuarine catches anywhere else in the west coast, constitutes more than 90% of the prawn population of this environment. It is also observed that this species grows very fast in this estuary when compared with the growth rates recorded from other natural nurseries (George 1962b, Subrahmanyam 1968). The average growth rate recorded during the present study is 25.3 mm|month. The maximum growth rate (37.50 mm|month) has been noticed in the younger stages when the estuary is land-locked. In Covelong backwaters, Muthu (Personal communication) has observed an average growth rate of 24.2 mm|month for the same species during May to November when the bar remains closed. Jhingran and Natarajan (1969) indirectly estimated a growth rate as high as 36 mm|month from the time it assumes benthic existence to size at detection in the Chilka Lake. Recent culture experiments of this species in brackish water indicate an average growth rate ranging between 19.35 mm and 25.81 mm per month for juveniles up to marketable size (Subrahmanyam and Rao 1968, Sultan *et al* 1973). Suseelan (1975) observed an average monthly growth of 24.68 mm for prawns up to 135 mm size in the saltpan reservoirs of this area, with a maximum growth rate of 30.55 mm|month in early stages. Still faster growth rates have been recorded in allied species from other regions. In *P. setiferus*, Gunter (1950) estimated a growth rate of 25 mm to 45 mm|month for prawns up to 100 mm size, while Linder and Anderson (1956) noticed a daily growth rate of 1.5 mm in early juveniles of 25 to 65 mm length range. In pond-culture experiments Johnson and Fielding (1956) obtained an average growth of 2.1 mm per day for this species. George (1961) and St. Amant *et al* (1963) have estimated average daily growths of nearly 1.4 mm and 1.7 mm respectively for juvenile prawns of *P. aztecus* in Louisiana waters.

The present study is too limited to explain the possible reasons for rapid growth of this species in this estuary. It is probable that an environment that is characterised by low salinity and normal temperature conditions is suitable for their rapid growth. The highest growth rates were recorded mostly when the bar remained closed and the salinity varied from 7.96 ‰ to 13.81 ‰ . In *P. aztecus*, Venkataramiah *et al* (1974) observed the highest growth rates for juvenile prawns in low salinity (8.5 ‰ - 17.9‰) and normal temperature (26°C) combinations.

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